

California High-Speed Train Project



TECHNICAL MEMORANDUM

Capital Cost Estimating Methodology for the 30% Design Level TM 1.1.22

Prepared by:	<u>Signed Document on File</u> Ted Lebida	<u>03 Mar 11</u> Date
Checked by:	<u>Signed Document on File</u> Vladimir Kanevskiy	<u>16 Mar 11</u> Date
Approved by:	<u>Signed Document on File</u> Ken Jong, PE, Engineering Manager	<u>29 Sep 11</u> Date
Released by:	<u>Signed Document on File</u> Hans Van Winkle, Program Director	<u>4 May 12</u> Date

Revision	Date	Description
0	03 Mar 11	Initial Release

Note: Signatures apply for the latest technical memorandum revision as noted above.

This document has been prepared by **Parsons Brinckerhoff** for the California High-Speed Rail Authority and for application to the California High-Speed Train Project. Any use of this document for purposes other than this Project, or the specific portion of the Project stated in the document, shall be at the sole risk of the user, and without liability to PB for any losses or injuries arising for such use.



System Level Technical and Integration Reviews

The purpose of the review is to ensure:

- Technical consistency and appropriateness
- Check for integration issues and conflicts

System level reviews are required for all technical memoranda. Technical Leads for each subsystem are responsible for completing the reviews in a timely manner and identifying appropriate senior staff to perform the review. Exemption to the system level technical and integration review by any subsystem must be approved by the Engineering Manager.

System Level Technical Reviews by Subsystem:

Systems:	<u>Signed Document on File</u> Richard Schmedes	<u>19 July 11</u> Date
Infrastructure:	<u>Signed Document on File</u> John Chirco, PE	<u>17 March 11</u> Date
Operations:	<u>Signed Document on File</u> Joseph Metzler	<u>29 March 11</u> Date
Rolling Stock:	<u>Signed Document on File</u> Frank Banko	<u>21 March 11</u> Date
Procurement	<u>Signed Document on File</u> Claudio Dallavalle	<u>29 April 11</u> Date
Project Management Oversight:	<u>Signed Document on File</u> Michael D. Lewis, PE	<u>22 November 11</u> Date

Note: Signatures apply for the technical memorandum revision corresponding to revision number in header and as noted on cover.



TABLE OF CONTENTS

ABSTRACT	1
1.0 INTRODUCTION.....	2
1.1 PURPOSE OF TECHNICAL MEMORANDUM	2
1.2 STATEMENT OF TECHNICAL ISSUE	2
1.3 GENERAL INFORMATION.....	2
1.3.1 DEFINITION OF TERMS.....	2
1.3.2 UNITS.....	3
2.0 DESIGN STANDARDS AND GUIDELINES.....	3
2.1 CAPITAL COST ESTIMATING METHODOLOGIES.....	3
2.2 POLICY CONSIDERATIONS	3
2.2.1 ESTIMATING FORMAT	3
2.2.2 ESTIMATING SOFTWARE	4
2.2.3 CONFIDENTIALITY	4
3.0 ASSESSMENT / ANALYSIS	4
3.1 ROLES AND RESPONSIBILITIES.....	4
3.2 ESTIMATING TASKS	5
3.2.1 TASK 1 - WORK BREAKDOWN STRUCTURE (WBS)	5
3.2.2 TASK 2 – DEVELOPMENT OF DETAILED COSTS	5
3.2.3 TASK 3 – QUANTITY TAKEOFFS	6
3.2.4 TASK 4 - CONSTRUCTION COST ESTIMATE (INCLUDING CONTINGENCY)	7
3.2.5 TASK 5 – PROPERTY ACQUISITIONS AND EASEMENT QUANTITIES.....	7
3.2.6 TASK 6 – RIGHT-OF-WAY COST ESTIMATE (INCLUDING CONTINGENCY)	7
3.2.7 TASK 7 – ROLLING STOCK PROCUREMENT ESTIMATE	7
3.2.8 TASK 8 – PROGRAM IMPLEMENTATION ADD-ONS	7
3.2.9 TASK 9 – ASSEMBLE PROGRAM WIDE COST ESTIMATE	8
3.2.10 TASK 10 – ESTIMATE VALIDATION.....	8
3.3 ESTIMATING METHODOLOGY AND STANDARDS	8
3.3.1 DESIGN GUIDELINES AND STANDARDS	8
3.3.2 SOFTWARE	8
3.3.3 COORDINATION WITH PROJECT CONTROL FUNCTIONS	8
3.4 PREPARATION OF 30% COST ESTIMATE	9
3.4.1 BASIS OF ESTIMATE	9
3.4.2 ESTIMATE RECONCILIATION	9
3.5 COST ESTIMATE PRICING METHODS FOR 30% DESIGN.....	10
3.5.1 UNIT PRICE ANALYSIS METHOD.....	10
3.5.2 HISTORICAL BID PRICE METHOD	10
3.5.3 ESTIMATES PRODUCED BY OTHER PARTIES	11
3.5.4 CONTINGENCY.....	11
3.5.5 BASE YEAR AND ESCALATION	14



3.5.6	PROGRAM IMPLEMENTATION COSTS	15
3.5.7	ESTIMATE VALIDATION	15
4.0	SUMMARY AND RECOMMENDATIONS.....	16
5.0	SOURCE INFORMATION AND REFERENCES.....	16
6.0	DESIGN MANUAL CRITERIA.....	17
6.1	ROLES AND RESPONSIBILITIES.....	17
6.2	ESTIMATING TASKS	17
6.2.1	TASK 1 - WORK BREAKDOWN STRUCTURE (WBS)	17
6.2.2	TASK 2 – DEVELOPMENT OF DETAILED COSTS.....	18
6.2.3	TASK 3 – QUANTITY TAKEOFFS	18
6.2.4	TASK 4 - CONSTRUCTION COST ESTIMATE (INCLUDING CONTINGENCY)	19
6.2.5	TASK 5 – PROPERTY ACQUISITIONS AND EASEMENT QUANTITIES.....	19
6.2.6	TASK 6 – RIGHT-OF-WAY COST ESTIMATE (INCLUDING CONTINGENCY)	19
6.2.7	TASK 7 – ROLLING STOCK PROCUREMENT ESTIMATE	19
6.2.8	TASK 8 – PROGRAM IMPLEMENTATION ADD-ONS	20
6.2.9	TASK 9 – ASSEMBLE PROGRAM WIDE COST ESTIMATE.....	20
6.2.10	TASK 10 – ESTIMATE VALIDATION.....	20
6.3	ESTIMATING METHODOLOGY AND STANDARDS	20
6.3.1	DESIGN GUIDELINES AND STANDARDS	20
6.3.2	SOFTWARE	20
6.3.3	COORDINATION WITH PROJECT CONTROL FUNCTIONS	21
6.4	PREPARATION OF 30% COST ESTIMATE	21
6.4.1	BASIS OF ESTIMATE	21
6.4.2	ESTIMATE RECONCILIATION	22
6.5	COST ESTIMATE PRICING METHODS FOR 30% DESIGN.....	22
6.5.1	UNIT PRICE ANALYSIS METHOD.....	22
6.5.2	HISTORICAL BID PRICE METHOD	23
6.5.3	ESTIMATES PRODUCED BY OTHER PARTIES	23
6.5.4	CONTINGENCY.....	23
6.5.5	BASE YEAR AND ESCALATION	27
6.5.6	PROGRAM IMPLEMENTATION COSTS	28
6.5.7	ESTIMATE VALIDATION	28
Appendix A	Work Breakdown Structure (WBS).....	29
Appendix B	Work Breakdown Structure (FRA Standard Cost Categories)	31
Appendix C	Elements Of Cost	34
Appendix D	Capital Cost Estimate Sign-Off Form.....	35
Appendix E	Final Cost Estimate Sign-Off Form	36



ABSTRACT

This technical memorandum describes the Capital Cost Estimating Methodology (CCEM) for the California High-Speed Train Project (CHSTP) and provides guidance for preparing and presenting estimated capital costs for the project's 30% Design level. It is expected that the definition of a detailed methodology for the preparation of capital costs will promote the development of cost estimates that will provide an accurate assessment of the construction/program cost for this project.

This document describes the roles and responsibilities for preparing estimates at the 30% Design level. It also will define the estimating tasks, procedures and standards for developing these components of the estimates and assemblage of such items to produce a complete estimate of construction/program costs that reflect the scope, schedule and complexity of the project. These costs will be broken down as a minimum to a level of detail consistent with the Work Breakdown Structure. It will specifically address the quantification of scope (development of quantities), interpretation of construction methodology and representation of such in the estimate and assembly of these items. The review and approval process of 30% Design level estimates will also be defined. The detailed methodology for estimating the project's capital costs is to provide the project with the required information for preparation of fiscal planning documents, budget forecasts and to provide a basis for supporting procurement of final design, construction services and to compare and evaluate contractor proposals.

1.0 INTRODUCTION

1.1 PURPOSE OF TECHNICAL MEMORANDUM

The purpose of this technical memorandum is to provide guidance for the preparation of reliable and accurate capital cost estimates for the 30% Design level.

This memo describes a program wide Capital Cost Estimating Methodology (CCEM) for the California High-Speed Train Project (CHSTP). With its size, complexity, phased design, and number of participants, it is important that the CCEM is flexible enough to be applied at each point in the project development process to appropriately support the tracking, monitoring and control of cost changes through each of the program's design and implementation phases. This document addresses only the capital cost estimating requirements for the 30% Design level, and specifically does suggest a Cost Trending Program (that must be the subject of a separate procedure).

1.2 STATEMENT OF TECHNICAL ISSUE

The guidance in this technical memorandum is intended to address the preparation of a program cost estimate, including construction, acquisition of right-of-way, engineering and management and related costs that may arise during execution of the project.

The CCEM is intended to provide guidelines for accurately and consistently estimating the costs of capital infrastructure and systems for the 30% Design level. It will also provide a framework for defining the scope and technical basis for the estimates, the roles and responsibilities for specific estimating tasks among the project participations, and the structure, organization, and format for reporting capital costs. This information will be used to prepare fiscal planning documents, budget forecasts and provide a basis for supporting procurement of final design, construction services and to compare and evaluate contractor proposals.

1.3 GENERAL INFORMATION

1.3.1 Definition of Terms

Technical terms, acronyms, or other cost estimating terminology specifically used for capital cost estimating purposes, unless otherwise indicated, will follow the standard definition of terms published by the Association for the Advancement of Cost Engineering (AACE) International in their Recommended Practice No. 10S-90 – Cost Engineering Terminology.

The following acronyms used in this document have specific connotations with regard to California High-Speed Train system.

Acronyms

ATC	Alternative Technical Concepts
AACE	Association for the Advancement of Cost Engineering
CCEM	Capital Cost Estimating Methodology
Authority	California High-Speed Rail Authority
CHSTP	California High-Speed Train Project
ENR	Engineering News Record
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
LCCA	Life Cycle Cost Analysis
O&M	Operating and Maintenance



PMT	Program Management Team
RC	Regional Consultant(s)
SCC	Standard Cost Categories
TM	Technical Memorandum
WBS	Work Breakdown Structure



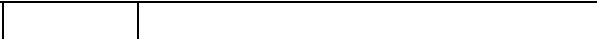
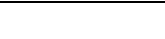


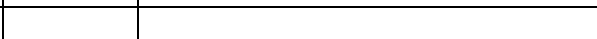
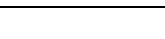


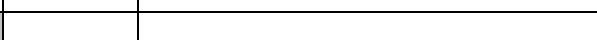
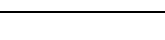


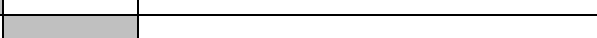
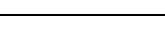




1.3.2 Units

The California High-Speed Train Project (CHSTP) is based on U.S. Customary Units consistent with guidelines prepared by the California Department of Transportation (Caltrans) and defined by the National Institute of Standards and Technology (NIST). U.S. Customary Units are officially used in the U.S. and are also known in the U.S. as “English” or “Imperial” units. In order to avoid any confusion, all formal references to units of measure should be made in terms of U.S. Customary Units.

2.0 DESIGN STANDARDS AND GUIDELINES

2.1 CAPITAL COST ESTIMATING METHODOLOGIES

Estimating methodologies are not static and must be flexible enough to adjust to the needs of the project's stage in the development process. The development process is described by the overall level of engineering design associated with the major development stages defined for the CHSTP:

Development Stage	Engineering Design Completion			
Programmatic EIR/S				
Project EIR/S				
15% Design Level				
30% Design Level				
Design-Build				
	15%	30%	90%	100%

Each development stage is represented by a range of engineering design completion and influenced by ongoing updates to the ridership demand forecast and associated revisions to estimated system capacity, service design and operating plans. Because of this variability, the appropriate estimating methods or procedures at a given milestone will be based on the actual levels of project engineering and scope definition present at that time. Because the program will be designed in multiple segments, and each segment is further broken down by Design-Build or Design-Bid-Build contract packages, the level of engineering design completed for major high-speed train system elements will be at different levels at any point in time. The goal of using established estimating methodologies is to assure that project estimates are prepared in a consistent and uniform manner, organized and standardized in methods, and formatted in order to facilitate estimate review and reporting.

2.2 POLICY CONSIDERATIONS

2.2.1 Estimating Format

A consistent format is required for the reporting, estimating, and managing of the project's capital costs. This document recommends using standard cost categories (SCC) established by the Federal Railroad Administration (FRA). Preparation of capital costs in SCC format will be required



throughout the preliminary design. Estimates will also need to have the ability to be sorted to support the cost reporting as required by the Work Break Down Structure Element and each segment is further broken down by Design-Build or Design-Bid-Build contract packages. The proposed level of detail along with the WBS will provide the ability to sort the estimate by numerous combinations of elements and allow for analysis of bid proposals including alternative technical concepts (ATCs) as submitted by bidders.

2.2.2 Estimating Software

In order to provide for uniformity between numerous corridors and Regional Consultants as well as a consistent platform to allow for anticipated reporting and analysis requirements of the program wide cost estimates, Timberline, a commercially available database software system will be used for the program-level preparation, compilation and reporting tasks performed by the PMT. Regional Consultants will be required to submit quantities in a summarized Excel format consistent with the WBS so as to allow electronic incorporation of quantities into Timberline. Regional Consultants will be required to present the quantities and provide detailed backup for all quantities and allowance items.

2.2.3 Confidentiality

Due to the nature of the project all cost estimates and cost data are considered confidential and may not be released without the authorization of the Authority. All persons working on cost data and estimates will be required to sign a confidentiality agreement.

3.0 ASSESSMENT / ANALYSIS

3.1 ROLES AND RESPONSIBILITIES

Project participants will work on different and/or multiple high-speed train corridors and will be working at varying stages of project development concurrently. Recognizing that the development of capital cost estimates involves the execution and coordination of a number of estimating tasks, one of the critical issues is the assigning of roles and responsibilities for these tasks.

The primary project participants that have a role in the Capital Cost Estimating Program are:

- California High-Speed Rail Authority (Authority)
- Program Management Team (PMT)
- Regional Consultants (RC)

Table 3-1 identifies the areas of responsibility for each estimating task, by participant, for the project's 30% Design level.

Table 3-1 Roles and Responsibilities for 30% Design

Task Estimating Task		30% Design Level		
		Authority	PMT	RC
1	Work Breakdown Structure (WBS) Contract Bid Items	R	P	-
2	Development of Detailed Costs	R	P	R
3	Quantity Takeoffs	-	R	P
4	Construction Cost Estimate	R	P	R
5	Property Takes and Easement Qty	-	R	P
6	Right-of-Way Cost Estimate	R	R	P
7	Rolling Stock Procurement Estimate	R	P	-
8	Program Implementation Add-ons	R	P	-
9	Program Wide Cost Estimate	R	P	-
10	Estimate Validation	R	P	P

Legend: **P** = Perform Work **R** = Review Work

3.2 ESTIMATING TASKS

3.2.1 Task 1 - Work Breakdown Structure (WBS)

This task involves the development of the Work Breakdown Structure (WBS) that will provide the basis for cost estimating and cost reporting. The WBS for estimating will include a coding system that will be used for developing estimating elements such as unit prices, quantities, labor, materials, construction equipment, etc. The WBS for reporting includes the development of a coding system that allows the cost estimates to be sorted and presented by elements such as geographic region, political or municipal boundaries, construction package, schedule of values for each contract, schedule activity, and similar project elements.

The WBS for capital cost estimates for the 30% Design level is based upon the FRA Standard Cost Categories and supplemented by the aforementioned elements. The WBS, inclusive of the standard cost categories, is presented in Appendices A and B.

3.2.2 Task 2 – Development of Detailed Costs

This task involves the development of construction unit prices for each of the construction activities that will be identified and quantified from the design documents in accordance with Section 3.5 Cost Estimate Pricing Methods for 30% Design. The development of individual unit prices will be accomplished by developing a cost for each line item. The unit price will be developed by establishing a crew (labor and construction equipment) to perform the work along with associated productivity. This crew will then have appropriate pricing applied to show labor, equipment and material rates to arrive at a unit price at the direct cost level.

An analysis will also be made, in close coordination with current program schedule requirements, to determine the need for extended work weeks or shift work and costs for these items. These



factors will be calculated and incorporated into the project estimate. A detailed analysis and calculation of Contractor Indirect Costs will also be performed. The estimate methodology and software tools will have the ability to spread these indirect costs against the unit prices at the direct cost level to produce an all-in unit cost.

Only when absolutely necessary, will unit prices be developed through the use of historical bid data and by unit cost analysis. This method to development of unit prices is to be used only when insufficient detail is available to preclude the development of crew-based pricing and only at the expressed consent of the Lead Estimating Manager.

Unit prices will be expressed in current year dollars and will be adjusted to reflect any regional variations typically seen in the State of California by utilizing labor, equipment and material pricing for that area of the state.

As a minimum requirement, the PMT will develop unit costs for all items of work to the level of detail as supplied by the Regional Consultants. The Regional Consultants will review unit price development details to ensure that construction methods and materials contained in the pricing are consistent with the design and construction methodology. Some items of cost that require additional attention are unique utility relocations, staged construction to accommodate existing rail or vehicular traffic, and restrictive site access conditions in urban areas, etc.

3.2.3 Task 3 – Quantity Takeoffs

This task involves preparing estimated quantities, either by direct measurement and calculation of construction elements that are shown in design drawings, electronically calculated from CADD files, or established as an allowance quantity based on professional experience and judgment.

Quantities will be prepared to at least the lowest element of the WBS (Appendix A) as defined by the latest edition of MASTERFORMAT 2004 (Appendix C) with the ability to be sorted by all of the possible combinations of sorting requirements as described in 3.2.1 Task 1 – Work Breakdown Structure. Regional Consultants will submit their quantities and back-up in a hard copy format and summarized electronically in Excel consistent with the WBS so as to allow the information to be electronically input into Timberline. Regional Consultants shall identify and use the appropriate source and methodology for quantity take-offs. The intent is to quantify the scope of the project as completely as possible. Should work activities be necessary to complete the final in place quantities but are not defined on the drawings, these items must also be quantified so as to give a complete calculation of cost (i.e. support of excavation, temporary workarounds etc.). The contract packages will be procured by means of either Design-Build or Design-Bid-Build as determined appropriate by the Authority. As a result, not all the work elements will be defined and detailed fully. However, the Regional Consultants shall be responsible to develop quantities in addition to description of size, capacity, material, etc., as much as practical and based on the respective discipline engineer's professional experience and judgment. Examples include stations and other facilities, finishes, electrical and mechanical material and equipment work elements.

When construction factors are used by the Regional Consultants to arrive at quantities, such factors will be documented by the Regional Consultants. Whether calculating concrete overbreak, buried bars/lap splices for reinforcing, earthwork bulk to CCY/LCY, or other calculation factors, the Regional Consultant will define the factors used in the quantity development. Guidance on construction factors can be provided by the PMT.

The Regional Consultants will make an interim submission of quantities for each construction contract package, supported by a complete set of in-progress drawings; technical specification; contract documents general and special provisions. This submittal must be received by the PMT at least four weeks prior to the final quantity submittal to allow the PMT to start developing the detailed estimate in sufficient time so as to identify areas that may be of concern due to cost growth.

The Regional Consultants will prepare and transmit final quantities in accordance with the WBS and/or contract document bid items. Once construction cost estimates are compiled by the PMT, Regional Consultants will review quantities within the estimates and provide written concurrence that the subject estimate represents quantities as intended. An example of the sign-off sheet used in documenting this concurrence is included as Appendix D.



3.2.4 Task 4 - Construction Cost Estimate (including Contingency)

This task involves the assembly and calculation of cost estimates for construction related activities using data developed in Tasks 1 through 3 and procedures described in Section 3.4 Preparation of 30% Cost Estimates, Section 3.5.5 Base Year and Escalation, and Section 3.5.6 Program Implementation, along with the application of appropriate contingencies as presented in Section 3.5.4 Contingency. The PMT will establish baseline contingencies for major cost categories for the 30% Design level, as presented in Table 3-2. Regional Consultants will participate in the development of contingencies through the Risk Analysis Process. The PMT will prepare program wide cost estimates based on the contingency values that are agreed upon by the PMT and Regional Consultants.

3.2.5 Task 5 – Property Acquisitions and Easement Quantities

This task involves preparing estimated quantities of impacted properties, either permanent takes or temporary easements, which result from construction, operation, and maintenance of proposed high-speed train alignment alternatives. The identification of property related impacts that need to be quantified must be performed in coordination with the methodology that will be used to develop the right-of-way cost estimates described in Task 6 – Right-of-Way Cost Estimates.

Regional Consultants will be responsible for preparing quantity estimates for property takes and easements. These estimated quantities need to be consistent with the WBS reporting requirements.

3.2.6 Task 6 – Right-of-Way Cost Estimate (including Contingency)

This task involves applying professional experience and judgment in the area of property valuation, business damages, and legal and administrative issues as they relate to the estimation of right-of-way costs. These estimates will need to include costs for items such as demolition of structures, mitigation costs for partial takings, building abatement, structure/land reconstruction costs, etc. These costs need to be developed to be in agreement with the development of construction costs so as to provide a complete accounting of costs required for the construction of the CHSTP. Some of these items may have to be carried in the construction costs depending upon who will perform the work. The means and methods used to develop these cost estimates will have a direct effect on Task 5 and on how property impacts are identified and quantified.

The quantities generated under Task 5 Property Acquisitions and Easement Quantities by the Regional Consultants will be priced by the Program Management Team to produce cost estimate(s) for acquisition of property, property rights and mitigating costs required for the construction, operation, and maintenance of the high-speed train system.

3.2.7 Task 7 – Rolling Stock Procurement Estimate

This task involves estimating the costs associated with the procurement of rolling stock, including both revenue and non-revenue vehicles, maintenance of way equipment, spare parts, etc. Cost estimates for this task will be dependent on the vehicle technology that is ultimately selected.

The PMT will prepare the rolling stock procurement estimate.

3.2.8 Task 8 – Program Implementation Add-ons

This task involves establishing percentage add-on allowances for project related professional services (SCC 80 WBS Appendix B) for items such as final engineering, (included in D-B contract package) project and construction management, agency program management, project insurance, commissioning and testing, and project start-up costs. These allowances will be computed by applying percentage factors to the total estimated construction cost (Task 4), excluding right-of-way and rolling stock costs since the total cost for these two items will include the management and administration costs associated with these activities.

The PMT will prepare the professional service categories and percentage factors.



3.2.9 Task 9 – Assemble Program Wide Cost Estimate

This task involves compiling and maintaining a program wide cost estimate by combining construction costs (Task 4), right-of-way costs (Task 6), rolling stock procurement costs (Task 7), and applying professional services costs (Task 8) to produce an estimate of the overall CHSTP program.

The PMT will prepare the program wide capital cost estimate based on quantities, project-specific unit costs and right-of-way acquisition costs, Rolling Stock Procurement and Program Implementation Add-ons.

3.2.10 Task 10 – Estimate Validation

Following preparation of the 30% Design level estimates, cost estimates will advance through a validation process as outlined in Section 3.5.7 Estimate Validation. This task will assemble subject matter experts in the areas of engineering, construction, and estimating to perform a review of the scope, assumptions and basis used to prepare the cost estimate. This process will provide a thorough vetting of each cost item and total before it is finalized.

In collaboration, the PMT and Regional Consultants will validate the 30% Design level cost estimates.

3.3 ESTIMATING METHODOLOGY AND STANDARDS

Multiple designers working concurrently on the project's multiple geographic segments requires that common design basis, criteria and standards; engineering assumptions; design guidance; and directive drawings are used to develop high-speed train alternatives and cost estimate quantities used in preparing the cost estimates. The following are guidelines and standards to be used in preparing the 30% Design level cost estimates.

3.3.1 Design Guidelines and Standards

CHSTP estimates shall be based on design guidelines defined in Technical Memoranda that have been issued or are under development. Criteria, guidelines and assumptions used to identify construction activities in capital cost estimates shall be in accordance with all approved technical memoranda and design guidance documents.

3.3.2 Software

Software for developing and preparing program capital cost estimates include standard spreadsheet programs, such as Microsoft Excel, or commercially produced database estimating programs.

Regional Consultants shall prepare quantities and transmit the information in a format so as to be in agreement with at least the lowest level of the WBS. Regional Consultants will submit their quantities and back-up in a hard copy format and summarized electronically in Excel consistent with the WBS and allows the information to be electronically input into Timberline. This will allow for development of estimates that will provide cost information to a level detailed enough to be a useful tool in the development of the overall project controls function.

The PMT shall compile and prepare segment, Design-Build or Design-Bid-Build contract package specific and overall program wide cost estimates using Timberline (a commercially available database program that will allow for the anticipated reporting and analysis needs of the program-wide cost estimates). The database software will be used primarily as a tool to compile quantities, develop detailed unit prices, allowances, contingencies and for reporting.

3.3.3 Coordination with Project Control Functions

There are a number of project controls disciplines that are typically associated with capital cost estimating that must be considered during the development of the CCEM. These include construction scheduling, cost and change control, and risk management. Regional Consultants shall be responsible for the coordination between their project control functions, including preparation of construction schedules for their respective segment and/or Design-Build or Design-Bid-Build contract package. The Program Management Team will be responsible for compiling



the overall project construction schedule based on individual construction schedules prepared by the Regional Consultants. This schedule will include all pertinent dates for each contract including procurement of contracts.

3.4 PREPARATION OF 30% COST ESTIMATE

The following information in the 30% Design level cost estimate quantities shall be prepared by the Regional Consultants for each project segment:

- Letter of transmittal
- Basis of estimated quantities
- Estimate reconciliation (quantities)
- Estimate quantities summary
- Details of estimated quantities
- Quantity takeoff summary (Excel)

The pricing of quantities as produced by the Regional Consultant will be done by the Program Management Team.

A description of the information to be included is summarized in the following section.

3.4.1 Basis of Estimate

The Basis of Estimate provides specific information related to the estimate and shall provide the following information:

- Scope of Estimate – a brief written description of what the estimate covers. (PMT and RC)
- Drawings – references the engineering drawings or sketches on which the quantity take-offs are based. Drawing set titles or description and publication date shall be listed. (RC)
- Specifications - the specifications that affect quantities provided for the estimate. (RC)
- Quantities - indicates how quantities were developed and calculated as well as any limitations. (RC)
- Construction Schedule - indicates start and finish dates and sequence of major phases of work pertinent to the estimate. (RC)
- Cost Exclusions - a list of any items not included in the estimate that may become a Project expense. (PMT and RC)
- Estimate Discussion/Comments - identifies any items that can affect either cost or schedule and that have not been covered in any of the above paragraphs. It also lists observations, recommendations, or unusual features of the project, from the estimator's perspective. (PMT and RC)
- Basis for Labor Component of Estimate and items of cost included in this cost. (PMT)
- Basis for Construction Equipment Cost and items of cost included. (PMT)
- Material Quotes and basis of pricing. (PMT)
- Synopsis of schedule analysis to justify shift work/extended work week. (PMT)
- Assumptions for Development of Contractor Indirect Costs. (PMT)
- Basis for Overhead and Profit (PMT)

Preparation of the Basis of Estimate is the responsibility of the Regional Consultants and the Program Management Team.

3.4.2 Estimate Reconciliation

Reconciliations will be made between 30% Design Level cost estimates and the 15% Design Level cost estimates. The goal of reconciliation is to identify and document significant changes that have occurred since the preparation of the prior capital cost estimate. Significant changes shall be identified in the reconciliation under one of three categories that best reflects the cause



for the change: Quantity, Unit Price, or Scope. These changes shall be referenced to specific line items in the estimate and shall include a brief written description of the change.

The PMT will prepare the 30% Design level capital cost estimate reconciliation with the programmatic capital cost estimate based on input from the Regional Consultants. The 15% cost estimate is the baseline cost against which the 30% cost estimate will be compared.

3.5 COST ESTIMATE PRICING METHODS FOR 30% DESIGN

The PMT with input from the RC will develop unit prices based on common methods used for estimating unit prices, including:

- Unit Price Analysis Method - Analysis of production rates, labor and equipment rates, and material costs for each construction activity.
- Historical bid price Method – Utilization of factored recent bid tabulations to arrive at cost items in 30% Design level Estimates.

These methods will be used either individually or in combination. For the 30% Design level, when limited engineering details are available, the historical bid price method may be used in conjunction with the Unit Price Analysis Method.

3.5.1 Unit Price Analysis Method

The unit price analysis method will typically be used to develop costs for most construction elements included in the project. This method allows for unit prices to be developed based on current local construction and market conditions, such as changes which might affect productivity or the cost of labor or materials. The following steps are required in order to develop a unit price using this method:

- Analyze the proposed construction conditions
- Develop Crew based pricing including labor, materials and construction equipment
- Estimate production rates
- Compile a list of materials
- Obtain materials prices using local, statewide or national available sources
- Determine labor and equipment rates
- Calculate direct unit price using the above factors
- Calculate Contractor Indirect Field Cost (or D-B contract general requirements), overhead and profit to arrive at an in place unit price

The following sources will be used to obtain basic cost data that is input into the database estimating program in order to develop any needed construction unit prices:

- Labor Rates – Federal Davis-Bacon Wage Determination and/or California Department of Industrial Relations Prevailing Wage Determinations.
- Equipment Rates – RS Means and/or U.S. Army Corp of Engineers Construction Equipment Ownership and Operating Expense Schedule, Region VII.
- Material Prices - Material and supply prices for locally statewide or nationally available material will be obtained from local supplier quotes, if possible. Secondary sources of material cost data may be taken from RS Means, Engineering News-Report (ENR) or other published resource.
- Databases prepared for commercially purchased estimating programs. These would have to be modified to reflect project specific conditions/requirements.

3.5.2 Historical Bid Price Method

The use of historical bid prices will be strongly discouraged to develop costs for common construction elements. A danger of using historical pricing is that it may be old, may not reflect the specific application, and may not reflect current local/regional conditions. Caltrans historical



pricing is derived from bid tabs. Contractors often front load bids, and the resulting unit costs may not reflect true pricing. In addition, this available information is not usually broken down into components of labor, material and equipment, as required for a workup of pricing. However when it proves necessary to use this method, the time of bid and conditions of the historical project used for pricing shall be taken into account and factors applied as needed:

- Adjust bid prices where the bid date is older than 12 months from the current date by using an appropriate escalation factor.
- Adjust bid prices to reflect conditions of the project, such as type of terrain, geographical location, soil, traffic and other related factors. For location factor adjustments, the City Cost Index as published by RS Means or other appropriate location adjustment factor shall be used as determined by the Project Estimating Manager.

Sources for historical bid prices that will be used may come from local, regional, statewide and national levels, as well as from international high-speed rail projects with unique high-speed elements. Historical unit prices that are used for the CHSTP will be verified for appropriateness and documented as to their source as well as any adjustments for site, escalation or location factors.

The same breakdown as the Unit Price Analysis Method of costs will be required for costs generated in this fashion i.e. labor, materials, construction equipment, contractor indirects, overhead and profit.

3.5.3 Estimates Produced By Other Parties

Throughout the 30% Design Process, estimates will be prepared by entities other than the Regional Consultants and Program Management Team (i.e. Caltrans, Third Party Designers, Force Account work, etc.). In order to provide consistency between all estimates prepared it will be necessary to prepare these estimates in the same format and level of detail as described in this Technical Memorandum.

3.5.4 Contingency

Contingencies are set-aside estimated amounts (monetary set-asides for cost) that are included within the overall cost targets for the project. Contingency account values are intended to overcome increases in cost that are due to potential risks, and for which no other mitigation measure is available. These contingency amounts may be associated with a particular activity or category of cost, or may be set aside in a general fund.

The risk informed contingency levels will be developed through application of the formal Risk Management Process, Risk Assessment, and Risk Evaluation and Analysis. The Risk Register will be structured so as to provide contingency amounts by Cost Category as shown in Table 3-2.

For the purposes of this estimating program, contingency will be assigned into two major categories – allocated and unallocated.

Allocated contingency will be added based on an assessment of the quality of design information available for individual items of work and will typically fall in a range of 10% to 20%. The exact percentage selected for each cost category is based on professional judgment and experience related to the cost variability typically seen for items of work within a particular cost category. The percentages shown in Table 3-2 are values that will be used until risk informed contingency levels are developed through application of the formal Risk Management Process.

Unallocated contingency is typically included to address uncertainties that are more global in nature, including schedule delays, changes in contracting environment, or other such issues that are not associated with individual construction activities. Unallocated contingencies will be estimated at 5 percent of the total construction costs but will be adjusted based on input from the Risk Management Process.



Table 3-2 Allocated Contingency by Cost Category

Cost Category No.		
10 TRACK STRUCTURES and TRACK		
10.01	Track structure: Viaduct	10%
10.02	Track structure: Major/Movable bridge	10%
10.03	Track structure: Undergrade Bridges	10%
10.04	Track structure: Culverts and drainage structures	10%
10.05	Track structure: Cut and Fill (> 4' height/depth)	20%
10.06	Track structure: At-grade (grading and subgrade stabilization)	10%
10.07	Track structure: Tunnel	20%
10.08	Track structure: Retaining walls and systems	10%
10.09	Track new construction: Conventional ballasted	10%
10.10	Track new construction: Non-ballasted	10%
10.11	Track rehabilitation: Ballast and surfacing	10%
10.12	Track rehabilitation: Ditching and drainage	10%
10.13	Track rehabilitation: Component replacement (rail, ties, etc)	10%
10.14	Track: Special track work (switches, turnouts, insulated joints)	10%
10.15	Track: Major interlocking	10%
10.16	Track: Switch heaters (with power and control)	10%
10.17	Track: Vibration and noise dampening	10%
10.18	Other linear structures including fencing, sound walls	10%
20 STATIONS, TERMINALS, INTERMODAL		
20.01	Station buildings: Intercity passenger rail only	20%
20.02	Station buildings: Joint use (commuter rail, intercity bus)	20%
20.03	Platforms	10%
20.04	Elevators, escalators	10%
20.05	Joint commercial development	15%
20.06	Pedestrian / bike access and accommodation, landscaping, parking lots	10%
20.07	Automobile, bus, van accessways including roads	10%
20.08	Fare collection systems and equipment	10%
20.09	Station security	15%
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS		
30.01	Administration building: Office, sales, storage, revenue counting	20%
30.02	Light maintenance facility	20%
30.03	Heavy maintenance facility	20%
30.04	Storage or maintenance-of-way building/bases	20%
30.05	Yard and yard track	15%



40 SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS		
40.01	Demolition, clearing, site preparation	15%
40.02	Site utilities, utility relocation	20%
40.03	Hazardous material, contaminated soil removal/mitigation, ground water treatments	20%
40.04	Environmental mitigation: wetlands, historic/archeology, parks	15%
40.05	Site structures including retaining walls, sound walls	10%
40.06	Temporary facilities and other indirect costs during construction	10%
40.07	Purchase or lease of real estate	30%
40.08	Highway/pedestrian overpass/grade separations	10%
40.09	Relocation of existing households and businesses	10%
50 COMMUNICATIONS AND SIGNALING		
50.01	Wayside signaling equipment	10%
50.02	Signal power access and distribution	10%
50.03	On-board signaling equipment	10%
50.04	Traffic control and dispatching systems	10%
50.05	Communications	10%
50.06	Grade crossing protection	10%
50.07	Hazard detectors: dragging equipment high water, slide, etc.	10%
50.08	Station train approach warning system	10%
60 ELECTRIC TRACTION		
60.01	Traction power transmission: High voltage	10%
60.02	Traction power supply: Substations	10%
60.03	Traction power distribution: Catenary and third rail	10%
60.04	Traction power control	10%
70 VEHICLES		
70.00	Vehicle acquisition: Electric locomotive	0%
70.01	Vehicle acquisition: Non-electric locomotive	0%
70.02	Vehicle acquisition: Electric multiple unit	0%
70.03	Vehicle acquisition: Diesel multiple unit	0%
70.04	Vehicle acquisition: Loco-hauled passenger cars w/ ticketed space	0%
70.05	Vehicle acquisition: Loco-hauled passenger cars w/o ticketed space	0%
70.06	Vehicle acquisition: Maintenance of way vehicles	0%
70.07	Vehicle acquisition: Non-railroad support vehicles	0%
70.08	Vehicle refurbishment: Electric locomotive	0%
70.09	Vehicle refurbishment: Non-electric locomotive	0%
70.10	Vehicle refurbishment: Electric multiple unit	0%
70.11	Vehicle refurbishment: Diesel multiple unit	0%
70.12	Vehicle refurbished: Passenger loco-hauled car w/ ticketed space	0%



70.13	Vehicle refurbished: Non-passenger loco-hauled car w/o ticketed space	0%
70.14	Vehicle refurbishment: Maintenance of way vehicles	0%
70.15	Spare parts	0%
80 PROFESSIONAL SERVICES (applies to Cats. 10-60)		
80.01	Service Development Plan/Service Environmental	10%
80.02	Preliminary Engineering/Project Environmental	10%
80.03	Final design	10%
80.04	Project management for design and construction	10%
80.05	Construction administration and management	10%
80.06	Professional liability and other non-construction insurance	10%
80.07	Legal; Permits; Review Fees by other agencies, cities, etc.	10%
80.08	Surveys, testing, investigation	10%
80.09	Engineering inspection	10%
80.10	Start up	10%

3.5.5 Base Year and Escalation

Estimates will be prepared in Base Year dollars with the Base Year defined as the current calendar year. Unit costs will be updated annually or as determined by the Project Controls Manager. For cost estimates with a base year that is older than the current calendar by one or more years, pricing will be adjusted by updating the labor equipment and material prices used in the database to the current year. A cost estimate prepared in the current base year cost will be projected into a future calendar year by using a cost escalation factor.

It is imperative that the individual components of the estimate including labor, material and equipment have escalation factors most applicable to each applied individually. Additionally components within the aforementioned categories shall have the most representative escalation applied to them ex. concrete, steel, pipe, etc.

There are a wide variety of published construction cost indexes and economic forecasting publications, from both governmental as well as private sources. These indexes are normally calculated using a set of defined construction or procurement commodities that the sponsoring group determines to be representative of the market sector that they are trying to monitor and predict. Some indexes track the in-place constructed cost for a set of commodities that include material, labor and equipment costs plus contractor's overhead and profit. Other indexes may only track certain material prices, labor costs, or the cost of goods and services sold. Another aspect of these indexes that can affect their usefulness is whether they are calculated using regional or national market information.

The CHSTP will consider a number of sources of information including Caltrans Highway Construction Index, California Department of Finance Economic Forecasts, and US Bureau of Labor Statistics Producer Price Index for highway construction, PB Consult Economic Forecast Review, and construction economics data published by *Engineering News- Record* (ENR). The determination as to which source of information to be used will be made by the Project Estimating Manager.

It is the intent to have PB Consult perform an escalation analysis and provide a written report recommending appropriate escalation factors to be applied to the various components of the unit costs.



3.5.6 Program Implementation Costs

Program Implementation costs are included to represent the costs of engineering, project and construction management, contract administration, insurance, permits and fees, training/start-up/testing and any force account work. These add-on costs will be calculated as a percentage of construction costs only (applied individually and not cumulatively and excluding vehicle procurement and right-of-way costs) and presented under Professional Services cost category in the estimate.

Service Development Plan/Service Environmental	(tbd)
Preliminary Engineering/Project Environmental	(tbd)
Final design	(tbd)
Project management for design and construction	(tbd)
Construction administration and management	(tbd)
Professional liability and other non-construction insurance	(tbd)
Legal; Permits; Review Fees by other agencies, cities, etc	(tbd)
Surveys, testing, investigation	(tbd)
Engineering inspection	(tbd)
Start up	(tbd)

3.5.7 Estimate Validation

A formal estimate validation meeting will be scheduled to include a select group of project participants representing the Authority, PMT, Regional Consultants and potentially outside subject matter experts. The purpose of this meeting will be to provide an opportunity to discuss and confirm the design, construction and estimating inputs and assumptions used to prepare the estimate. All changes, adjustments and concurrence will be documented in meeting minutes. Those changes/adjustments that are accepted at this meeting will then be incorporated to produce the final estimate submittal. The estimate will be revised so as to show the changes incorporated from the initial estimate prepared for the estimate validation meeting. Estimates will be considered a draft until they receive a final review and approval by Authority staff. Concurrence of the estimate and accepted changes will be documented by signing off on the Final Estimate Sign Off Sheet included as Appendix E. This sheet will be signed by the Project Controls Manager (PMT), Project Director (PMT) and Project Director (Authority). Authority approval is required prior to the release of any estimate information to anyone other than a project participant.

4.0 SUMMARY AND RECOMMENDATIONS

Recommended methodologies for preparing the 30 % Design level capital cost estimate are presented in Section 6.0.

5.0 SOURCE INFORMATION AND REFERENCES

1. Capital Cost Estimating Program Manual – Charlotte Area Transit System (February 2006)
2. Federal Railroad Administration Standard Cost Categories for Capital Projects/Programs*
3. California High-Speed Rail Authority - 2009 Report to the Legislature
4. International Association for the Advancement of Cost Engineering (AACE) - Recommended Practice No. 10S-90 – Cost Engineering Terminology
5. Association for the Advancement of Cost Estimating. International Practice No. 17R-97. Cost Estimate Classification System. TCM Framework: 7.3 – Cost Estimate and Budgeting. 2003.

6.0 DESIGN MANUAL CRITERIA

6.1 ROLES AND RESPONSIBILITIES

Project participants will work on different and/or multiple high-speed train corridors and will be working at varying stages of project development concurrently. Recognizing that the development of capital cost estimates involves the execution and coordination of a number of estimating tasks, one of the critical issues is the assigning of roles and responsibilities for these tasks.

The primary project participants that have a role in the Capital Cost Estimating Program are:

- California High-Speed Rail Authority (Authority)
- Program Management Team (PMT)
- Regional Consultants (RC)

Table 6-1 identifies the areas of responsibility for each estimating task, by participant, for the project's 30% Design level.

Table 6-1 Roles and Responsibilities for 30% Design

Task		30% Design Level		
		Authority	PMT	RC
1	Work Breakdown Structure (WBS) Contract Bid Items	R	P	-
2	Development of Detailed Costs	R	P	R
3	Quantity Takeoffs	-	R	P
4	Construction Cost Estimate	R	P	R
5	Property Takes and Easement Qty	-	R	P
6	Right-of-Way Cost Estimate	R	R	P
7	Rolling Stock Procurement Estimate	R	P	-
8	Program Implementation Add-ons	R	P	-
9	Program Wide Cost Estimate	R	P	-
10	Estimate Validation	R	P	P

Legend: **P** = Perform Work **R** = Review Work

6.2 ESTIMATING TASKS

6.2.1 Task 1 - Work Breakdown Structure (WBS)

This task involves the development of the Work Breakdown Structure (WBS) that will provide the basis for cost estimating and cost reporting. The WBS for estimating will include a coding system that will be used for developing estimating elements such as unit prices, quantities, labor, materials, construction equipment, etc. The WBS for reporting includes the development of a coding system that allows the cost estimates to be sorted and presented by elements such as geographic region, political or municipal boundaries, construction package, schedule of values for each contract, schedule activity, and similar project elements.

The WBS for capital cost estimates for the 30% Design level is based upon the FRA Standard Cost Categories and supplemented by the aforementioned elements. The WBS, inclusive of the standard cost categories, is presented in Appendices A and B.



6.2.2 Task 2 – Development of Detailed Costs

This task involves the development of construction unit prices for each of the construction activities that will be identified and quantified from the design documents in accordance with Section 6.5 Cost Estimate Pricing Methods for 30% Design. The development of individual unit prices will be accomplished by developing a cost for each line item. The unit price will be developed by establishing a crew (labor and construction equipment) to perform the work along with associated productivity. This crew will then have appropriate pricing applied to show labor, equipment and material rates to arrive at a unit price at the direct cost level.

An analysis will also be made, in close coordination with current program schedule requirements, to determine the need for extended work weeks or shift work and costs for these items. These factors will be calculated and incorporated into the project estimate. A detailed analysis and calculation of Contractor Indirect Costs will also be performed. The estimate methodology and software tools will have the ability to spread these indirect costs against the unit prices at the direct cost level to produce an all-in unit cost.

Only when absolutely necessary, will unit prices be developed through the use of historical bid data and by unit cost analysis. This method to development of unit prices is to be used only when insufficient detail is available to preclude the development of crew-based pricing and only at the expressed consent of the Lead Estimating Manager.

Unit prices will be expressed in current year dollars and will be adjusted to reflect any regional variations typically seen in the State of California by utilizing labor, equipment and material pricing for that area of the state.

As a minimum requirement, the PMT will develop unit costs for all items of work to the level of detail as supplied by the Regional Consultants. The Regional Consultants will review unit price development details to ensure that construction methods and materials contained in the pricing are consistent with the design and construction methodology. Some items of cost that require additional attention are unique utility relocations, staged construction to accommodate existing rail or vehicular traffic, and restrictive site access conditions in urban areas etc.

6.2.3 Task 3 – Quantity Takeoffs

This task involves preparing estimated quantities, either by direct measurement and calculation of construction elements that are shown in design drawings, electronically calculated from CADD files or established as an allowance quantity based on professional experience and judgment.

Quantities will be prepared to at least the lowest element of the WBS (Appendix A) as defined by the latest edition of MASTERFORMAT 2004 (Appendix C) with the ability to be sorted by all of the possible combinations of sorting requirements as described in 6.2.1 Task 1 – Work Breakdown Structure. Regional Consultants will submit their quantities and back-up in a hard copy format and summarized electronically in Excel consistent with the WBS so as to allow the information to be electronically input into Timberline. Regional Consultants shall identify and use the appropriate source and methodology for quantity take-offs. The intent is to quantify the scope of the project as completely as possible. Should work activities be necessary to complete the final in place quantities but are not defined on the drawings these items must also be quantified so as to give a complete calculation of cost (i.e. support of excavation, temporary workarounds etc.). The contract packages will be procured by means of either Design-Build or Design-Bid-Build as determined appropriate by the Authority. As a result, not all the work elements will be defined and detailed fully. However, the Regional Consultants shall be responsible to develop quantities in addition to description of size, capacity, material, etc. as much as practical and based on the respective discipline engineer's professional experience and judgment. Examples include stations and other facilities, finishes, electrical and mechanical material and equipment work elements.

When construction factors are used by the Regional Consultants to arrive at quantities such factors will be documented by the Regional Consultants. Whether calculating concrete overbreak, buried bars/lap splices for reinforcing, earthwork bulk to CCY/LCY, or other calculation factors the



Regional Consultant will define the factors used in the quantity development. Guidance on construction factors can be provided by the PMT.

The Regional Consultants will make an interim submission of quantities for each construction contract package, supported by a complete set of in-progress drawings; technical specification; contract documents general and special provisions. This submittal must be received by the PMT at least four weeks prior to the final quantity submittal to allow the PMT to start developing the detailed estimate in sufficient time so as to identify areas that may be of concern due to cost growth.

The Regional Consultants will prepare and transmit final quantities in accordance with the WBS and/or contract document bid items. Once construction cost estimates are compiled by the PMT, Regional Consultants will review quantities within the estimates and provide written concurrence that subject estimate represent quantities as intended. An example of the sign-off sheet used in documenting this concurrence is included as Appendix D.

6.2.4 Task 4 - Construction Cost Estimate (including Contingency)

This task involves the assembly and calculation of cost estimates for construction related activities using data developed in Tasks 1 through 3 and procedures described in Section 6.4 Preparation of 30% Cost Estimates, Section 6.5.4 Base Year and Escalation, and Section 6.5.5 Program Implementation, along with the application of appropriate contingencies as presented in Section 6.5.3 Contingency. The PMT will establish baseline contingencies for major cost categories for the 30% Design level, as presented in Table 3-2. Regional Consultants will participate in the development of contingencies through the Risk Analysis Process. The PMT will prepare program wide cost estimates based on the contingency values that are agreed upon by the PMT and Regional Consultants.

6.2.5 Task 5 – Property Acquisitions and Easement Quantities

This task involves preparing estimated quantities of impacted properties, either permanent takes or temporary easements, which result from construction, operation, and maintenance of proposed high-speed train alignment alternatives. The identification of property related impacts that need to be quantified must be performed in coordination with the methodology that will be used to develop the right-of-way cost estimates described in Task 6 – Right-of-Way Cost Estimates.

Regional Consultants will be responsible for preparing quantity estimates for property takes and easements. These estimated quantities need to be consistent with the WBS reporting requirements.

6.2.6 Task 6 – Right-of-Way Cost Estimate (including Contingency)

This task involves applying professional experience and judgment in the area of property valuation, business damages, and legal and administrative issues as they relate to the estimation of right-of-way costs. These estimates will need to include costs for items such as demolition of structures, mitigation costs for partial takings, building abatement, structure/land reconstruction costs, etc. These costs need to be developed to be in agreement with the development of construction costs so as to provide a complete accounting of costs required for the construction of the CHSTP. Some of these items may have to be carried in the construction costs depending upon who will perform the work. The means and methods used to develop these cost estimates will have a direct effect on Task 5 and on how property impacts are identified and quantified.

The quantities generated under Task 5 Property Acquisitions and Easement Quantities by the Regional Consultants will be priced by the Program Management Team to produce cost estimate(s) for acquisition of property, property rights and mitigating costs required for the construction, operation, and maintenance of the high-speed train system.

6.2.7 Task 7 – Rolling Stock Procurement Estimate

This task involves estimating the costs associated with the procurement of rolling stock, including both revenue and non-revenue vehicles, maintenance of way equipment, spare parts, etc. Cost estimates for this task will be dependent on the vehicle technology that is ultimately selected.



The PMT will prepare the rolling stock procurement estimate.

6.2.8 Task 8 – Program Implementation Add-ons

This task involves establishing percentage add-on allowances for project related professional services (SCC 80 WBS Appendix B) for items such as final engineering, (included in D-B contract package) project and construction management, agency program management, project insurance, commissioning and testing, and project start-up costs. These allowances will be computed by applying percentage factors to the total estimated construction cost (Task 4), excluding right-of-way and rolling stock costs since the total cost for these two items will include the management and administration costs associated with these activities.

The PMT will prepare the professional service categories and percentage factors.

6.2.9 Task 9 – Assemble Program Wide Cost Estimate

This task involves compiling and maintaining a program wide cost estimate by combining construction costs (Task 4), right-of-way costs (Task 6), rolling stock procurement costs (Task 7), and applying professional services costs (Task 8) to produce an estimate of the overall CHSTP program.

The PMT will prepare the program wide capital cost estimate based on quantities, project-specific unit costs and right-of-way acquisition costs, Rolling Stock Procurement and Program Implementation Add-ons.

6.2.10 Task 10 – Estimate Validation

Following preparation of the 30% Design level estimates, cost estimates will advance through a validation process as outlined in Section 6.5.7 Estimate Validation. This task will assemble subject matter experts in the areas of engineering, construction, and estimating to perform a review of the scope, assumptions and basis used to prepare the cost estimate. This process will provide a thorough vetting of each cost item and total before it is finalized.

In collaboration, the PMT and Regional Consultants will validate the 30% Design level cost estimates.

6.3 ESTIMATING METHODOLOGY AND STANDARDS

Multiple designers working concurrently on the project's multiple geographic segments requires that common design basis, criteria and standards; engineering assumptions; design guidance; and directive drawings are used to develop high-speed train alternatives and cost estimate quantities used in preparing the cost estimates. The following are guidelines and standards to be used in preparing the 30% Design level cost estimates.

6.3.1 Design Guidelines and Standards

CHSTP estimates shall be based on design guidelines defined in Technical Memoranda that have been issued or are under development. Criteria, guidelines and assumptions used to identify construction activities in capital cost estimates shall be in accordance with all approved technical memoranda and design guidance documents.

6.3.2 Software

Software for developing and preparing program capital cost estimates include standard spreadsheet programs, such as Microsoft Excel, or commercially produced database estimating programs.

Regional Consultants shall prepare quantities and transmit the information in a format so as to be in agreement with at least the lowest level of the WBS. Regional Consultants will submit their quantities and back-up in a hard copy format and summarized electronically in Excel consistent with the WBS and allows the information to be electronically input into Timberline. This will allow for development of estimates that will provide cost information to a level detailed enough to be useful tool in the development of the overall project controls function.



The PMT shall compile and prepare segment, Design-Build or Design-Bid-Build contract package specific and overall program wide cost estimates using Timberline a commercially available database program that will allow for the anticipated reporting and analysis needs of the program-wide cost estimates. The database software will be used primarily as a tool to compile quantities, develop detailed unit prices, allowances, contingencies and for reporting.

6.3.3 Coordination with Project Control Functions

There are a number of project controls disciplines that are typically associated with capital cost estimating that must be considered during the development of the CCEM. These include construction scheduling, cost and change control, and risk management. Regional Consultants shall be responsible for the coordination between their project control functions, including preparation of construction schedules for their respective segment and/or Design-Build or Design-Bid-Build contract package. The Program Management Team will be responsible for compiling the overall project construction schedule based on individual construction schedules prepared by the Regional consultants. This schedule will include all pertinent dates for each contract including procurement of contracts.

6.4 PREPARATION OF 30% COST ESTIMATE

The following information in the 30% Design level cost estimate quantities shall be prepared by the Regional Consultants for each project segment:

- Letter of transmittal
- Basis of estimated quantities
- Estimate reconciliation (Quantities)
- Estimate quantities summary
- Details of estimated quantities
- Quantity takeoff summary (Excel)

The pricing of quantities as produced by the Regional Consultant will be done by the Program Management Team.

A description of the information to be included is summarized in the following section.

6.4.1 Basis of Estimate

The Basis of Estimate provides specific information related to the estimate and shall provide the following information:

- Scope of Estimate – a brief written description of what the estimate covers. (PMT and RC)
- Drawings – references the engineering drawings or sketches on which the quantity take-offs are based. Drawing set titles or description and publication date shall be listed. (RC)
- Specifications - the specifications that affect quantities provided for the estimate. (RC)
- Quantities - indicates how quantities were developed and calculated as well as any limitations. (RC)
- Construction Schedule - indicates start and finish dates and sequence of major phases of work pertinent to the estimate. (RC)
- Cost Exclusions - a list of any items not included in the estimate that may become a Project expense. (PMT and RC)
- Estimate Discussion/Comments - identifies any items that can affect either cost or schedule and that have not been covered in any of the above paragraphs. It also lists observations, recommendations, or unusual features of the project, from the estimator's perspective. (PMT and RC)
- Basis for Labor Component of Estimate and items of cost included in this cost. (PMT)
- Basis for Construction Equipment Cost and items of cost included. (PMT)
- Material Quotes and basis of pricing. (PMT)
- Synopsis of schedule analysis to justify shift work/extended work week. (PMT)



- Assumptions for Development of Contractor Indirect Costs. (PMT)
- Basis for Overhead and Profit (PMT)

Preparation of the Basis of Estimate is the responsibility of the Regional Consultants and the Program Management Team.

6.4.2 Estimate Reconciliation

Reconciliations will be made between 30% Design Level cost estimates and the 15% Design Level cost estimates. The goal of reconciliation is to identify and document significant changes that have occurred since the preparation of the prior capital cost estimate. Significant changes shall be identified in the reconciliation under one of three categories that best reflects the cause for the change: Quantity, Unit Price, or Scope. These changes shall be referenced to specific line items in the estimate and shall include a brief written description of the change.

The PMT will prepare the 30% Design level capital cost estimate reconciliation with the programmatic capital cost estimate based on input from the Regional Consultants. The 15% cost estimate is the baseline cost against which the 30% cost estimate will be compared.

6.5 COST ESTIMATE PRICING METHODS FOR 30% DESIGN

The PMT with input from the RC will develop unit prices based on common methods used for estimating unit prices, including:

- Unit Price Analysis Method - Analysis of production rates, labor and equipment rates, and material costs for each construction activity.
- Historical bid price Method – Utilization of factored recent bid tabulations to arrive at cost items in 30% Design Level Estimates.

These methods will be used either individually or in combination. For the 30% Design level, when limited engineering details are available, the historical bid price method may be used in conjunction with the Unit Price Analysis Method.

6.5.1 Unit Price Analysis Method

The unit price analysis method will typically be used to develop costs for most construction elements included in the project. This method allows for unit prices to be developed based on current local construction and market conditions, such as changes which might affect productivity or the cost of labor or materials. The following steps are required in order to develop a unit price using this method:

- Analyze the proposed construction conditions
- Develop Crew based pricing including labor, materials and construction equipment
- Estimate production rates
- Compile a list of materials
- Obtain materials prices using local, statewide or national available sources
- Determine labor and equipment rates
- Calculate direct unit price using the above factors
- Calculate Contractor Indirect Field Cost (or D-B contract general requirements), overhead and profit to arrive at an in place unit price

The following sources will be used to obtain basic cost data that is input into the database estimating program in order to develop any needed construction unit prices:

- Labor Rates – Federal Davis-Bacon Wage Determination and/or California Department of Industrial Relations Prevailing Wage Determinations.
- Equipment Rates – RS Means and/or U.S. Army Corp of Engineers Construction Equipment Ownership and Operating Expense Schedule, Region VII.



- Material Prices - Material and supply prices for locally statewide or nationally available material will be obtained from local supplier quotes, if possible. Secondary sources of material cost data may be taken from RS Means, Engineering News-Report (ENR) or other published resource.
- Databases prepared for commercially purchased estimating programs. These would have to be modified to reflect project specific conditions/requirements.

6.5.2 Historical Bid Price Method

The use of historical bid prices will be strongly discouraged to develop costs for common construction elements. A danger of using historical pricing is that it may be old, may not reflect the specific application, and may not reflect current local/regional conditions. Caltrans historical pricing is derived from bid tabs. Contractors often front load bids, and the resulting unit costs may not reflect true pricing. In addition, this available information is not usually broken down into components of labor, material and equipment, as required for a workup of pricing. However when it proves necessary to use this method, the time of bid and conditions of the historical project used for pricing shall be taken into account and factors applied as needed:

- Adjust bid prices where the bid date is older than 12 months from the current date by using an appropriate escalation factor
- Adjust bid prices to reflect conditions of the project, such as type of terrain, geographical location, soil, traffic and other related factors. For location factor adjustments, the City Cost Index as published by RS Means or other appropriate location adjustment factor shall be used as determined by the Project Estimating Manager.

Sources for historical bid prices that will be used may come from local, regional, statewide and national levels, as well as from international high-speed rail projects with unique high-speed elements. Historical unit prices that are used for the CHSTP will be verified for appropriateness and documented as to their source as well as any adjustments for site, escalation or location factors.

The same breakdown as the Unit Price Analysis Method of costs will be required for costs generated in this fashion i.e. Labor, Materials, Construction Equipment, Contractor Indirects, Overhead and Profit.

6.5.3 Estimates Produced By Other Parties

Throughout the 30% Design Process, estimates will be prepared by entities other than the Regional Consultants and Program Management Team (i.e. Caltrans, Third Party Designers, Force Account work, etc.). In order to provide consistency between all estimates prepared it will be necessary to prepare these estimates in the same format and level of detail as described in this Technical Memorandum.

6.5.4 Contingency

Contingencies are set-aside estimated amounts (monetary set-asides for cost) that are included within the overall cost targets for the project. Contingency account values are intended to overcome increases in cost that are due to potential risks, and for which no other mitigation measure is available. These contingency amounts may be associated with a particular activity or category of cost, or may be set aside in a general fund.

The risk informed contingency levels will be developed through application of the formal Risk Management Process, Risk Assessment, and Risk Evaluation and Analysis. The Risk Register will be structured so as to provide contingency amounts by Cost Category as shown in Table 6-2.

For the purposes of this estimating program, contingency will be assigned into two major categories – allocated and unallocated.



Allocated contingency will be added based on an assessment of the quality of design information available for individual items of work and will typically fall in a range of 10% to 20%. The exact percentage selected for each cost category is based on professional judgment and experience related to the cost variability typically seen for items of work within a particular cost category. The percentages shown in Table 3-2 are values that will be used until risk informed contingency levels are developed through application of the formal Risk Management Process.

Unallocated contingency is typically included to address uncertainties that are more global in nature including schedule delays, changes in contracting environment, or other such issues that are not associated with individual construction activities. Unallocated contingencies will be estimated at 5 percent of the total construction costs but will be adjusted based on input from the Risk Management Process.

Table 6-2 Allocated Contingency by Cost Category

Cost Category No.		
10 TRACK STRUCTURES and TRACK		
10.01	Track structure: Viaduct	10%
10.02	Track structure: Major/Movable bridge	10%
10.03	Track structure: Undergrade Bridges	10%
10.04	Track structure: Culverts and drainage structures	10%
10.05	Track structure: Cut and Fill (> 4' height/depth)	20%
10.06	Track structure: At-grade (grading and subgrade stabilization)	10%
10.07	Track structure: Tunnel	20%
10.08	Track structure: Retaining walls and systems	10%
10.09	Track new construction: Conventional ballasted	10%
10.10	Track new construction: Non-ballasted	10%
10.11	Track rehabilitation: Ballast and surfacing	10%
10.12	Track rehabilitation: Ditching and drainage	10%
10.13	Track rehabilitation: Component replacement (rail, ties, etc)	10%
10.14	Track: Special track work (switches, turnouts, insulated joints)	10%
10.15	Track: Major interlocking	10%
10.16	Track: Switch heaters (with power and control)	10%
10.17	Track: Vibration and noise dampening	10%
10.18	Other linear structures including fencing, sound walls	10%
20 STATIONS, TERMINALS, INTERMODAL		
20.01	Station buildings: Intercity passenger rail only	20%
20.02	Station buildings: Joint use (commuter rail, intercity bus)	20%
20.03	Platforms	10%
20.04	Elevators, escalators	10%
20.05	Joint commercial development	15%
20.06	Pedestrian / bike access and accommodation, landscaping, parking lots	10%
20.07	Automobile, bus, van accessways including roads	10%
20.08	Fare collection systems and equipment	10%
20.09	Station security	15%
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS		
30.01	Administration building: Office, sales, storage, revenue counting	20%
30.02	Light maintenance facility	20%
30.03	Heavy maintenance facility	20%
30.04	Storage or maintenance-of-way building/bases	20%
30.05	Yard and yard track	15%



40 SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS		
40.01	Demolition, clearing, site preparation	15%
40.02	Site utilities, utility relocation	20%
40.03	Hazardous material, contaminated soil removal/mitigation, ground water treatments	20%
40.04	Environmental mitigation: wetlands, historic/archeology, parks	15%
40.05	Site structures including retaining walls, sound walls	10%
40.06	Temporary facilities and other indirect costs during construction	10%
40.07	Purchase or lease of real estate	30%
40.08	Highway/pedestrian overpass/grade separations	10%
40.09	Relocation of existing households and businesses	10%
50 COMMUNICATIONS AND SIGNALING		
50.01	Wayside signaling equipment	10%
50.02	Signal power access and distribution	10%
50.03	On-board signaling equipment	10%
50.04	Traffic control and dispatching systems	10%
50.05	Communications	10%
50.06	Grade crossing protection	10%
50.07	Hazard detectors: dragging equipment high water, slide, etc.	10%
50.08	Station train approach warning system	10%
60 ELECTRIC TRACTION		
60.01	Traction power transmission: High voltage	10%
60.02	Traction power supply: Substations	10%
60.03	Traction power distribution: Catenary and third rail	10%
60.04	Traction power control	10%
70 VEHICLES		
70.00	Vehicle acquisition: Electric locomotive	0%
70.01	Vehicle acquisition: Non-electric locomotive	0%
70.02	Vehicle acquisition: Electric multiple unit	0%
70.03	Vehicle acquisition: Diesel multiple unit	0%
70.04	Vehicle acquisition: Loco-hauled passenger cars w/ ticketed space	0%
70.05	Vehicle acquisition: Loco-hauled passenger cars w/o ticketed space	0%
70.06	Vehicle acquisition: Maintenance of way vehicles	0%
70.07	Vehicle acquisition: Non-railroad support vehicles	0%
70.08	Vehicle refurbishment: Electric locomotive	0%
70.09	Vehicle refurbishment: Non-electric locomotive	0%
70.10	Vehicle refurbishment: Electric multiple unit	0%
70.11	Vehicle refurbishment: Diesel multiple unit	0%
70.12	Vehicle refurbished: Passenger loco-hauled car w/ ticketed space	0%



70.13	Vehicle refurbished: Non-passenger loco-hauled car w/o ticketed space	0%
70.14	Vehicle refurbishment: Maintenance of way vehicles	0%
70.15	Spare parts	0%
80 PROFESSIONAL SERVICES (applies to Cats. 10-60)		
80.01	Service Development Plan/Service Environmental	10%
80.02	Preliminary Engineering/Project Environmental	10%
80.03	Final design	10%
80.04	Project management for design and construction	10%
80.05	Construction administration and management	10%
80.06	Professional liability and other non-construction insurance	10%
80.07	Legal; Permits; Review Fees by other agencies, cities, etc.	10%
80.08	Surveys, testing, investigation	10%
80.09	Engineering inspection	10%
80.10	Start up	10%

6.5.5 Base Year and Escalation

Estimates will be prepared in Base Year dollars with the Base Year defined as the current calendar year. Unit costs will be updated annually or as determined by the Project Controls Manager. For cost estimates with a base year that is older than the current calendar by one or more years, pricing will be adjusted by updating the labor equipment and material prices used in the database to the current year. A cost estimate prepared in the current base year cost will be projected into a future calendar year by using a cost escalation factor.

It is imperative that the individual components of the estimate including labor, material and equipment have escalation factors most applicable to each applied individually. Additionally components within the aforementioned categories shall have the most representative escalation applied to them ex. concrete, steel, pipe, etc.

There are a wide variety of published construction cost indexes and economic forecasting publications, from both governmental as well as private sources. These indexes are normally calculated using a set of defined construction or procurement commodities that the sponsoring group determines to be representative of the market sector that they are trying to monitor and predict. Some indexes track the in-place constructed cost for a set of commodities that include material, labor and equipment costs plus contractor's overhead and profit. Other indexes may only track certain material prices, labor costs, or the cost of goods and services sold. Another aspect of these indexes that can affect their usefulness is whether they are calculated using regional or national market information.

The CHSTP will consider a number of sources of information including Caltrans Highway Construction Index, California Department of Finance Economic Forecasts, and US Bureau of Labor Statistics Producer Price Index for highway construction, PB Consult Economic Forecast Review, and construction economics data published by *Engineering News- Record* (ENR). The determination as to which source of information to be used will be made by the Project Estimating Manager.

It is the intent to have PB Consult perform an escalation analysis and provide a written report recommending appropriate escalation factors to be applied to the various components of the unit costs.



6.5.6 Program Implementation Costs

Program Implementation costs are included to represent the costs of engineering, project and construction management, contract administration, insurance, permits and fees, training/start-up/testing and any force account work. These add-on costs will be calculated as a percentage of construction costs only (applied individually and not cumulatively and excluding vehicle procurement and right-of-way costs) and presented under Professional Services cost category in the estimate.

Service Development Plan/Service Environmental	(tbd)
Preliminary Engineering/Project Environmental	(tbd)
Final design	(tbd)
Project management for design and construction	(tbd)
Construction administration and management	(tbd)
Professional liability and other non-construction insurance	(tbd)
Legal; Permits; Review Fees by other agencies, cities, etc	(tbd)
Surveys, testing, investigation	(tbd)
Engineering inspection	(tbd)
Start up	(tbd)

6.5.7 Estimate Validation

A formal estimate validation meeting will be scheduled to include a select group of project participant's representing the Authority, PMT, Regional Consultants and potentially outside subject matter experts. The purpose of this meeting will be to provide an opportunity to discuss and confirm the design, construction and estimating inputs and assumptions used to prepare the estimate. All changes, adjustments and concurrence will be documented in meeting minutes. Those changes/adjustments that are accepted at this meeting will then be incorporated to produce the final estimate submittal. The estimate will be revised so as to show the changes incorporated from the initial estimate prepared for the estimate validation meeting. Estimates will be considered a draft until they receive a final review and approval by Authority staff. Concurrence of the estimate and accepted changes will be documented by signing off on the Final Estimate Sign-Off Sheet included as Appendix E. This sheet will be signed by the Project Controls Manager (PMT), Project Director (PMT) and Project Director (Authority). Authority approval is required prior to the release of any estimate information to anyone other than a project participant.

APPENDIX A WORK BREAKDOWN STRUCTURE (WBS)



Summary Level
WBS
CALIFORNIA HIGH SPEED TRAIN PROJECT ESTIMATE WBS

					Standard Cost Categories				CSI MASTERFORMAT DESIGNATION			
WBS Level 1	WBS Level 2	WBS Level 3	WBS Level 4	WBS Level 5	WBS Level 6	WBS Level 7	WBS Level 8	WBS Level 9	WBS Level 10	WBS Level 11	WBS Level 12	WBS Level 13
Geographic Section	Subsection	Alignments	Contract	Schedule Activity	SCC - Major	SCC - Minor	Guideway Type	Group Phase	Phase	item	Funding Source	Estimator



APPENDIX B WORK BREAKDOWN STRUCTURE (FRA STANDARD COST CATEGORIES)

10 TRACK STRUCTURES and TRACK	
10.01	Track structure: Viaduct
10.02	Track structure: Major/Movable bridge
10.03	Track structure: Undergrade Bridges
10.04	Track structure: Culverts and drainage structures
10.05	Track structure: Cut and Fill (> 4' height/depth)
10.06	Track structure: At-grade (grading and subgrade stabilization)
10.07	Track structure: Tunnel
10.08	Track structure: Retaining walls and systems
10.09	Track new construction: Conventional ballasted
10.10	Track new construction: Non-ballasted
10.11	Track rehabilitation: Ballast and surfacing
10.12	Track rehabilitation: Ditching and drainage
10.13	Track rehabilitation: Component replacement (rail, ties, etc)
10.14	Track: Special track work (switches, turnouts, insulated joints)
10.15	Track: Major interlockings
10.16	Track: Switch heaters (with power and control)
10.17	Track: Vibration and noise dampening
10.18	Other linear structures including fencing, sound walls
20 STATIONS, TERMINALS, INTERMODAL	
20.01	Station buildings: Intercity passenger rail only
20.02	Station buildings: Joint use (commuter rail, intercity bus)
20.03	Platforms
20.04	Elevators, escalators
20.05	Joint commercial development
20.06	Pedestrian / bike access and accommodation, landscaping, parking lots
20.07	Automobile, bus, van accessways including roads
20.08	Fare collection systems and equipment
20.09	Station security
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	
30.01	Administration building: Office, sales, storage, revenue counting
30.02	Light maintenance facility
30.03	Heavy maintenance facility
30.04	Storage or maintenance-of-way building/bases
30.05	Yard and yard track
40 SITEWORK, RIGHT OF WAY, LAND, EXISTING IMPROVEMENTS	



40.01	Demolition, clearing, site preparation
40.02	Site utilities, utility relocation
40.03	Hazardous material, contaminated soil removal/mitigation, ground water treatments
40.04	Environmental mitigation: wetlands, historic/archeology, parks
40.05	Site structures including retaining walls, sound walls
40.06	Temporary facilities and other indirect costs during construction
40.07	Purchase or lease of real estate
40.08	Highway/pedestrian overpass/grade separations
40.09	Relocation of existing households and businesses
50 COMMUNICATIONS and SIGNALING	
50.01	Wayside signaling equipment
50.02	Signal power access and distribution
50.03	On-board signaling equipment
50.04	Traffic control and dispatching systems
50.05	Communications
50.06	Grade crossing protection
50.07	Hazard detectors: dragging equipment high water, slide, etc.
50.08	Station train approach warning system
60 ELECTRIC TRACTION	
60.01	Traction power transmission: High voltage
60.02	Traction power supply: Substations
60.03	Traction power distribution: Catenary and third rail
60.04	Traction power control
70 VEHICLES	
70.00	Vehicle acquisition: Electric locomotive
70.01	Vehicle acquisition: Non-electric locomotive
70.02	Vehicle acquisition: Electric multiple unit
70.03	Vehicle acquisition: Diesel multiple unit
70.04	Vehicle acquisition: Loco-hauled passenger cars w/ ticketed space
70.05	Vehicle acquisition: Loco-hauled passenger cars w/o ticketed space
70.06	Vehicle acquisition: Maintenance of way vehicles
70.07	Vehicle acquisition: Non-railroad support vehicles
70.08	Vehicle refurbishment: Electric locomotive
70.09	Vehicle refurbishment: Non-electric locomotive
70.10	Vehicle refurbishment: Electric multiple unit
70.11	Vehicle refurbishment: Diesel multiple unit
70.12	Vehicle refurbished: Passenger loco-hauled car w/ ticketed space
70.13	Vehicle refurbished: Non-passenger loco-hauled car w/o ticketed space
70.14	Vehicle refurbishment: Maintenance of way vehicles



70.15	Spare parts
80 PROFESSIONAL SERVICES (applies to Cats. 10-60)	
80.01	Service Development Plan/Service Environmental
80.02	Preliminary Engineering/Project Environmental
80.03	Final design
80.04	Project management for design and construction
80.05	Construction administration and management
80.06	Professional liability and other non-construction insurance
80.07	Legal; Permits; Review Fees by other agencies, cities, etc.
80.08	Surveys, testing, investigation
80.09	Engineering inspection
80.10	Start up
90 UNALLOCATED CONTINGENCY	
100 FINANCE CHARGES	

APPENDIX C ELEMENTS OF COST

See Latest Edition Masterformat 2004

<http://www.csinet.org/masterformat>



APPENDIX D CAPITAL COST ESTIMATE SIGN-OFF FORM

CAPITAL COST ESTIMATE SIGN-OFF FORM

ENVIRONMENTAL SEGMENT _____

DESIGN MILESTONE _____

QUANTITIES
REVIEWED BYSignature: _____
Print name: _____, Regional Consultant Team _____ DateUNIT PRICES
REVIEWED BYSignature: _____
Print name: _____, PMT Lead Estimator _____ DateESTIMATE
REVIEWED BYSignature: _____
Print name: _____, PMT Regional Manager _____ Date

APPENDIX E FINAL COST ESTIMATE SIGN-OFF FORM

FINAL COST ESTIMATE SIGN-OFF FORM

ENVIRONMENTAL SEGMENT _____

DESIGN MILESTONE _____

ESTIMATE
REVIEWED BYSignature: _____
Print name: _____, PMT Project Controls Manager _____ DateESTIMATE
REVIEWED BYSignature: _____
Print name: _____, PMT Project Director _____ DateESTIMATE
REVIEWED BYSignature: _____
Print name: _____, AUTHORITY Project Director _____ Date